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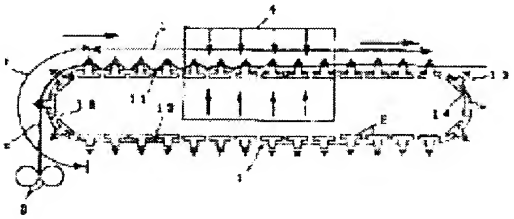
(54) PRODUCTION OF PHASE DIFFERENCE PLATE

(57)Abstract:
PURPOSE: To provide the process capable of easily producing the phase difference plate having the phase difference compensation performance and angle of field characteristic uniform and excellent over approximately the entire area of a film.
CONSTITUTION: A film gripping means 10 is constituted of a pair of endless guide rails 1 which consist of an upper linear guide part 11 and a lower linear guide part 12 as well as two curved guide parts 13, 14 connecting the ends of these linear guide parts to each other and are arranged in parallel and plural jig 2 groups which are mounted on these guide rails by providing prescribed intervals, travel on these guide rails and grip both transverse ends of the film (p). The transversely uniaxially stretched thermoplastic resin film is supplied to such film gripping means. Both transverse ends of the film are successively gripped in the curved guide part 13 of the guide rails and while the film is slacked in the upper linear guide part 11, the film is thermally shrunk in its longitudinal direction.



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CLAIMS

[Claim(s)]
[Claim 1]In a method of carrying out horizontal uniaxial stretching of the thermoplastic resin film, and carrying out heat contraction of the lengthwise direction of this thermoplastic resin film, and manufacturing a phase difference plate, An endless form guide rail of a couple by which comprised two curved-guides parts which connect an end comrade inside [which is extended to an abbreviated horizontal direction / which were provided in this lower part side] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals, such as this, and parallel arrangement was carried out in parallel, A film holding means is constituted from two or more jig groups which provide a predetermined interval in each guide rail, and it is equipped, and it runs each guide rail top, and grasp transverse direction both ends of the above-mentioned thermoplastic resin film, A thermoplastic resin film by which horizontal uniaxial stretching was carried out to this film holding means is supplied, An interval of the tip side comrade between each jig makes transverse direction both ends of the above-mentioned thermoplastic resin film grasp one by one in a curved-guides part of a guide rail which spreads from the end face side comrade's interval, and. A manufacturing method of a phase difference plate slacking the above-mentioned thermoplastic resin film in an inside of a straight-line proposal of a guide rail where an interval of the tip side comrade between each jig is shortened at that end face side comrade's interval, and carrying out heat contraction of the above-mentioned thermoplastic resin film in this state where it slackened.
[Claim 2]In a method of carrying out horizontal uniaxial stretching of the thermoplastic resin film, and carrying out heat contraction of the lengthwise direction of this thermoplastic resin film, and manufacturing a phase difference plate, The first guide rail of endless form that comprises two curved-guides parts which connect an end comrade inside [which was extended to an abbreviated horizontal direction and equipped that way with linear shape pars convoluta lobuli corticalis renis / which were provided in this lower part side] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals, such as this, The second guide rail of endless form in which has symmetrical shape to this first guide rail, and parallel arrangement of the interval between each inside of an upper part straight-line proposal was carried out so that the downstream might spread from the upstream bordering on the above-

mentioned pars convoluta lobuli corticalis renis, A film holding means is constituted from two or more jig groups which provide a predetermined interval in each guide rail, and it is equipped, and it runs each guide rail top, and grasp transverse direction both ends of the above-mentioned thermoplastic resin film, Supply a thermoplastic resin film to this film holding means, and an interval of the tip side comrade between each jig makes transverse direction both ends of the above-mentioned thermoplastic resin film grasp one by one in a curved-guides part of a guide rail which spreads from that end face side comrade's interval, and. in an inside of a straight-line proposal of a guide rail shortened at the end face side comrade's interval, an interval of the tip side comrade between each jig the above-mentioned thermoplastic resin film, [make slacken it and] A manufacturing method of a phase difference plate carrying out heat contraction of the lengthwise direction of a thermoplastic resin film in this state, and carrying out stretching treatment to a transverse direction of ******.

[Claim 3]A manufacturing method of the phase difference plate according to claim 1 or 2, wherein the above-mentioned jig constitutes that principal part from a bottom clip attached to a guide chain with which a guide rail is equipped, and a upper part clip removablely attached to this bottom clip.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the phase difference plate which comprises a thermoplastic resin film by which uniaxial stretching was carried out, for example, is used suitably for a liquid crystal display panel etc., especially, it excels in a view angle characteristic and, moreover, the unevenness of a phase difference value is related with the manufacturing method of few phase difference plates.

[0002]

[Description of the Prior Art]With a phase difference plate (film), the extended birefringence (since the refractive indicees of the direction which intersects perpendicularly with the extension direction and it by the molecular orientation by extension differ, generated) of a high polymer film is used, For example, it is a thing which makes the phase contrast produced with the liquid crystal of the liquid crystal display panel cancel (it is called phase contrast compensation), As this kind of a phase difference plate (film), conventionally Cellulose type resin (refer to JP,S63-167363,A), VCM/PVC system resin (refer to JP,S45-34477,B and JP,S56-125702,A), Polycarbonate system resin (refer to JP,S41-12190,B and JP,S56-130703,A), Acrylonitrile series resin (refer to JP,S56-130702,A), It is known that uniaxial-stretching processing will be carried out and films, such as styrene resin (refer to JP,S56-125703,A) and olefin system resin (refer to JP,S60-24502,A), can be manufactured, As the uniaxial-stretching method, vertical uniaxial stretching (refer to JP,H2-191904,A), horizontal uniaxial stretching (refer to JP,H2-42406,A), etc. are proposed.

[0003]And the above-mentioned phase contrast compensating performance of a phase

difference plate (film) is called retardation values, and is expressed with deltanxd. Here, deltan is the anisotropy of a refractive index and d is the thickness of a film.

[0004]By the way, if the angle of incident light and the normal to a film plane in which it succeeds increases, the above-mentioned retardation values will change and coloring of liquid crystal display (increase and decrease differ by the case where it is made to rotate with an axis vertical to the case where it is made to rotate centering on the extension direction, and the extension direction) will produce them.

[0005]An optically anisotropic body like a phase difference plate (film) does not have a uniform refractive index (nx, ny, nz) of the direction of a three dimension, and is expressed by an index ellipsoid. And if the axis and z which intersect x perpendicularly with a drawing axis and intersect y perpendicularly with the extension direction in a film plane are made into the normal line direction of a film for example, in uniaxial stretched film p shown in drawing 7, the relation of an all directions-oriented refractive index, There is a relation of nx>ny>=nz with a film positive in a peculiar refractive index, and there is a relation of nx<ny<=nz with a film negative in a peculiar refractive index. In a perfect uniaxial stretched film, the refractive index ny of the extension direction in a film plane and the direction y which intersects perpendicularly, and the refractive index nz of the normal line direction z of a film are equal, and ny=nz is materialized.

[0006]The double reflex [$deltan_{xz}$ (theta)] and retardation values [R_{xz} (theta)] which were hereafter seen from the direction of which theta (viewing angle) inclination was done from the z-axis in xz side as an example are expressed with the following formulas, respectively (refer to the 40th page of the electronic industry material February, 1991 item).

[0007]

[Equation 1]

$$\Delta n_{XZ}(\theta) = nx \cdot nz \cdot n / (nx^2 \sin^2\theta - nz^2 \sin^2\theta + n^2 \cdot nz^2)^{1/2} - ny \quad (1)$$

$$R_{XZ}(\theta) = \Delta n_{XZ}(\theta) \cdot d / (1 - \sin^2\theta / n^2)^{1/2} \quad (2)$$

However, are the thickness of a film and n of the inside d of a formula is an average refractive index.

[0008]And the result calculated based on above (1) and (2) type is shown in drawing 8.

[0009]In the graph charts of drawing 8, value R_{xz}(theta)/R_{xz} (0) which broke retardation-values R_{xz} [in / in a horizontal axis / the viewing angle theta / in / in a vertical axis / the viewing angle theta] (theta) by retardation-values R_{xz} (0) of the viewing angle 0 (when it sees from the normal line direction z) in xz side is shown, The rate of change of the retardation R is expressed with the absolute value of [1-R_{xz}(theta)/R_{xz} (0)]. In the inside a of drawing 8, the perfect uniaxial stretched film of nz=ny is shown and b shows the perfect uniaxial stretched film of nz<ny.

[0010]Here, an angle of visibility is so large that the rate of change of the retardation R, i.e., the absolute value of [1-R_{xz}(theta)/R_{xz} (0)], is small. And if the direction of perfect uniaxial stretching (nz=ny) becomes few in a retardation value change, an angle of visibility becomes large

and optically biaxial exists in another side and the orientation of a molecule from drawing 8 (nz<ny), the above-mentioned retardation value change can check the large thing which an angle of visibility becomes very narrow.

[0011]The calculation result at the time of using the viewing angle phi inclined from the z-axis in yz side instead of theta is shown in drawing 9. In the inside c of drawing 9, the perfect uniaxial stretched film of nz=ny is shown and d shows the perfect uniaxial stretched film of nz<ny.

[0012]When optically biaxial is in the orientation of a molecule also from this result, and the rate of a retardation value change, That is, the absolute value of $[1-R_{yz}(phi)/R_{yz}(0)]$ becomes large, an angle of visibility becomes narrow, the rate of a retardation value change, i.e., the absolute value of $[1-R_{yz}(phi)/R_{yz}(0)]$, becomes so small that another side and the uniaxial orientation nature of a molecule are high, and an angle of visibility becomes large. It turns out that an angle of visibility becomes large most in the case of perfect uniaxial stretching of nz=ny.

[0013]Therefore, the result of drawing 8, such as this, and drawing 9 shows that the rate of a retardation value change is so small that the uniaxial orientation nature of a molecule is high also when seeing from which direction, and an angle of visibility is large.

[0014]By the way, in order to improve optically uniaxial [of molecular orientation], it is required to make as small as possible the stress (remaining stress which it is going to reduce) generated in the direction vertical to the extension direction. What is necessary is in other words to reduce only the reduction amount considered to produce in extension in the direction vertical to the extension direction in the direction vertical to the extension direction.

[0015]In JP,H2-191904,A, it is called below this rate of the reduction percentage [neck in (the length rate of change of the film of the extension direction before and behind extension and the direction which intersects perpendicularly is said). Namely, rate of the neck in =(B-A)/Bx100; The length of the direction to which the extension direction after annealing and A cross at right angles here, B examines] which is the lay length which intersects perpendicularly with the extension direction of the film before extension, It is indicating that the phase difference plate (film) excellent in the view angle characteristic can be manufactured by setting this rate of the neck in to x(square root of 1-1/draw magnification) 100 (%) - (cube root of 1-1/draw magnification) x100 (%). And the method (the vertical 1 axis free width extending method) of extending to a lengthwise direction is indicated, setting the distance between extension rolls as 5 or more times of film width, and allowing free crosswise contraction as this concrete method.

[0016]A pantographic simultaneous 2 axis tenter drawing machine is applied to JP,H3-23405,A, The crosswise both ends of a film are selectively held with a tenter clip, the both directions of a lengthwise direction and the cross direction are extended simultaneously, and the method of manufacturing the phase difference plate which has 0 and a rate of the neck in - (square root of 1-1/draw magnification) is indicated.

[0017]

[Problem(s) to be Solved by the Invention]However, since the method currently indicated by JP,H2-191904,A had set the distance between extension rolls as 5 or more times of film width to have mentioned above, it had a problem in which it is difficult to continue the whole region between rolls and to control the cooking temperature under extension uniformly.

[0018]Since stretching treatment to the film longitudinal direction has been performed allowing free contraction of the cross direction of a film between the extension rolls which opened the interval by this method and have been arranged, Compared with the shrinkage amount of the cross direction of the film in an extension roll near part, the crosswise shrinkage amount of the film in near an extension roll Manaka center section becomes large, There was a fault originates in the difference in this contraction and the direction of the drawing axis (extension principal axis) in the crosswise both ends of a film and the direction of the drawing axis in a film center section stop corresponding. [whose] Therefore, since the phase contrast compensating performance and view angle characteristic were different in the crosswise both ends and center section of the film by which stretching treatment was carried out, the crosswise both ends of the film had to be discarded in large quantities as inferior goods, and there was a problem that the yield was bad.
[0019]On the other hand, in the method currently indicated by JP,H3-23405,A, Since the crosswise both ends of the film were selectively held with the tenter clip and stretching treatment had been performed, the neck in occurred in the part which is not held with the above-mentioned tenter clip, and there was a problem in the phase contrast compensating performance of a phase difference plate and the homogeneity of a view angle characteristic which were manufactured.
[0020]This invention was made paying attention to such a problem, and the place made into the SUBJECT covers the almost all region of a film, and there is in providing the method that the phase difference plate which has the phase contrast compensating performance which was uniform and was excellent, and a view angle characteristic can be manufactured easily.
[0021]
[Means for Solving the Problem]Namely, an invention concerning Claim 1 is premised on a method of carrying out horizontal uniaxial stretching of the thermoplastic resin film, and carrying out heat contraction of the lengthwise direction of this thermoplastic resin film, and manufacturing a phase difference plate, An endless form guide rail of a couple by which comprised two curved-guides parts which connect an end comrade inside [which is extended to an abbreviated horizontal direction / which were provided in this lower part side] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals, such as this, and parallel arrangement was carried out in parallel, A film holding means is constituted from two or more jig groups which provide a predetermined interval in each guide rail, and it is equipped, and it runs each guide rail top, and grasp transverse direction both ends of the above-mentioned thermoplastic resin film, A thermoplastic resin film by which horizontal uniaxial stretching was carried out to this film holding means is supplied, An interval of the tip side comrade between each jig makes transverse direction both ends of the above-mentioned thermoplastic resin film grasp one by one in a curved-guides part of a guide rail which spreads from the end face side comrade's interval, and. An invention which is characterized by slacking the above-mentioned thermoplastic resin film in an inside of a straight-line proposal of a guide rail where an interval of the tip side comrade between each jig is shortened at that end face side comrade's interval, and carrying out heat contraction of the above-mentioned thermoplastic resin film in this state where it slackened, and relates to another side and Claim 2, It is premised on a method of carrying out horizontal uniaxial stretching of the thermoplastic resin film, and carrying out heat contraction of

the lengthwise direction of this thermoplastic resin film, and manufacturing a phase difference plate, The first guide rail of endless form that comprises two curved-guides parts which connect an end comrade inside [which was extended to an abbreviated horizontal direction and equipped that way with linear shape pars convoluta lobuli corticalis renis / which were provided in this lower part side] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals, such as this, The second guide rail of endless form in which has symmetrical shape to this first guide rail, and parallel arrangement of the interval between each inside of an upper part straight-line proposal was carried out so that the downstream might spread from the upstream bordering on the above-mentioned pars convoluta lobuli corticalis renis, A film holding means is constituted from two or more jig groups which provide a predetermined interval in each guide rail, and it is equipped, and it runs each guide rail top, and grasp transverse direction both ends of the above-mentioned thermoplastic resin film, Supply a thermoplastic resin film to this film holding means, and an interval of the tip side comrade between each jig makes transverse direction both ends of the above-mentioned thermoplastic resin film grasp one by one in a curved-guides part of a guide rail which spreads from that end face side comrade's interval, and. in an inside of a straight-line proposal of a guide rail shortened at the end face side comrade's interval, an interval of the tip side comrade between each jig the above-mentioned thermoplastic resin film, [make slacken it and] Heat contraction of the lengthwise direction of a thermoplastic resin film is carried out in this state, and stretching treatment is carried out to a transverse direction of ******.

[0022]A bottom clip with which an invention concerning Claim 3 was attached to a guide chain with which a guide rail is equipped with the above-mentioned jig on the assumption that a manufacturing method of the phase difference plate according to claim 1 or 2, That principal part consists of upper part clips removablely attached to this bottom clip.

[0023]It is necessary to improve optically uniaxial [of molecular orientation] for manufacturing a phase difference plate with a large angle of visibility in such technical means. For that purpose, it is necessary to make as small as possible stress (stress which it is going to reduce) generated in the direction vertical to the extension direction as mentioned above. What is necessary is in other words to reduce only a reduction amount equivalent to stress generated in extension in the direction vertical to the extension direction after the time of extension, or extension.

[0024]And a film which carried out horizontal uniaxial stretching in an invention concerning Claim 1 is slacked between jigs, heat contraction of the lengthwise direction of a film is carried out in this state where it slackened, and it is improving optically uniaxial [of a phase difference plate].

[0025]that is, The endless form guide rail 1 (one side is not shown) of a couple by which comprised the two curved-guides parts 13 and 14 which connect an end comrade inside [which is horizontally extended as shown in drawing 1 / 11 / which were provided in this lower part side / 12 / 11 and 12] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals, such as this, and parallel arrangement was carried out in parallel, The film holding means 10 is constituted from two or more jig 2 groups which provide a predetermined interval in each guide rail 1, and it is equipped, and it runs each guide rail 1 top, and grasp transverse direction both ends of thermoplastic film p, Thermoplastic resin film p by which horizontal uniaxial stretching was carried out to this film holding means 10 is supplied via the

carrying roll 3, An interval of the tip side comrade between each jig 2 makes transverse direction both ends of the above-mentioned thermoplastic resin film p grasp one by one in the curved-guides part 13 of the guide rail 1 which spreads from the end face side comrade's interval, as shown in drawing 1 - drawing 2, and. After slacking the above-mentioned thermoplastic resin film p uniformly in the inside 11 of an upper part straight-line proposal of the guide rail 1 where an interval of the tip side comrade between each jig 2 is shortened at the end face side comrade's interval, It heat-treats in the oven 4, heat contraction of the lengthwise direction of thermoplastic resin film p is carried out, and it improves optically uniaxial [of a phase difference plate]. That is, an invention concerning Claim 1 uses that intervals of the tip side comrade between each jig 2 differ in the time of curve running of the curved-guides part 13, and straight travelling inside [11] a straight-line proposal (section r) (section L).

[0026]After supplying thermoplastic resin film p from the lower part side in drawing 1 and making it grasp one by one with the jig 2 in the curved-guides part 13, carry out heat contraction, slacking thermoplastic resin film p in the inside 11 of an upper part straight-line proposal, but. After supplying the above-mentioned thermoplastic resin film p from the upper part side and making it grasp one by one with the jig 2 in the curved-guides part 13, a method which carries out heat contraction may be taken slacking thermoplastic resin film p in the inside 12 of a bottom straight-line proposal.

[0027]And a reduction amount can be freely set to height h of the jig 2 with the turning radius R of the above-mentioned curved-guides part 13, as shown in drawing 2. This reduction percentage is given by /beta in the state (beta-alpha) where it slackened between jigs as shown in drawing 3. However, beta shows length for slack of the film p, and alpha shows an interval (namely, interval of the end face side comrade between each jig) between each jig.

[0028]Hereafter, in Table 1, relation between the above-mentioned R, h, and reduction percentage is illustrated.

[0029]

[Table 1]

R \ h	20 mm	30 mm
100 mm	16.5 %	22.8 %
150 mm	11.7 %	16.6 %
200 mm	9.1 %	13.0 %

Although a thermoplastic resin film which carried out horizontal uniaxial stretching beforehand in an invention concerning Claim 1 is supplied to the above-mentioned film holding means and a phase difference plate is manufactured, It is characterized by performing simultaneously stretching treatment to a transverse direction (namely, cross direction) of the above-mentioned thermoplastic resin film, and heat contraction processing to a lengthwise direction in an invention concerning Claim 2.

[0030]that is, The first guide rail 1 of endless form that comprises two curved-guides parts (not shown) which connect an end comrade inside [which was extended to an abbreviated horizontal direction and equipped that way with linear shape pars-convoluta-lobuli-corticalis-renis 17 ** as shown in drawing 4 / 11 / which were provided in this lower part side] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals (not shown), such as this, Second guide rail of endless form 1' to which has symmetrical shape to this first guide rail 1, and parallel arrangement of the interval between each inside of an upper part straight-line proposal was carried out so that the downstream 19 might spread from the upstream 18 bordering on the above-mentioned pars convoluta lobuli corticalis renis 17, establishing an interval predetermined in each guide rails 1 and 1, and being equipped -- and each guide rails 1 and 1 -- an invention which relates to Claim 1 except for a point which constituted a film holding means from two or more jig 2 groups which it runs a top and grasp transverse direction both ends of thermoplastic resin film p -- abbreviated -- it is the same.
[0031]As a jig with which the above-mentioned guide rail is equipped in the invention concerning Claims 1-2, such as this, if neither a tear nor a slide happens to a film, anythings are applicable. A tenter clip, a pin, a needle, etc. are mentioned as an example.
[0032]And since the defective part (imperfect alignment) of the neck in which is a problem of the free extension in JP,H2-191904,A mentioned above was not restrained by extension direction crossing at a right angle, at a center and both ends, the drawing axis (optical principal axis of a phase difference plate) shifted greatly, and had generated it.
[0033]On the other hand, in order that the wave shape produced according to the slack of a film in the invention concerning Claims 1-3 may act as binding force to the extension direction crossing at a right angle of a film and may enable equivalent contraction of the lengthwise direction of a film, the evil of the manufacturing method indicated by above-mentioned JP,H2-191904,A is canceled.
[0034]The device converted into structure which mentioned above the drive of the jig which grasps the transverse direction both ends of a film in a horizontal uniaxial-stretching machine as actual equipment is applicable, In comparison with the manufacturing method indicated by JP,H2-191904,A, control of the extension temperature at the time of extension is easy, and application of a cheap and easy device is possible in comparison with the manufacturing method indicated by JP,H3-23405,A.
[0035]Horizontal uniaxial stretching in the invention concerning Claims 1-3 is horizontal uniaxial stretching by a tenter drawing machine, and terms and conditions, such as the extension temperature, draw magnification, a stretching speed, heat setting (heat treatment after extension) temperature, and heat setting time, are set up suitably become a desired phase difference value.
[0036]The process at which heat treatment in inventions, such as this, grasps the transverse direction both ends of a thermoplastic resin film in the curved-guides part of a guide rail, In the inside of the straight-line proposal of a guide rail, a heat contraction process is comprised in the above-mentioned film, and terms and conditions, such as a reduction amount etc. of cooking temperature, a heating rate, the extension direction, and the direction that intersects perpendicularly, are set up suitably become a desired phase difference value.
[0037]Next, as a thermoplastic resin film applied in these technical means, For example, cellulose

type resin, VCM/PVC system resin, polycarbonate system resin, Films, such as acrylonitrile series resin, olefin system resin, polystyrene system resin, poly-methyl-methacrylate system resin, Pori Sall John system resin, polyarylate system resin, and polyether sulphone system resin, are mentioned.

[0038]As a manufacturing method of these films, it may manufacture by any of the solvent cast method, the calendar method, or an extrusion method.

[0039]

[Function]The endless form guide rail of the couple by which comprised two curved-guides parts which connect the end comrade inside [which is extended to an abbreviated horizontal direction / which were provided in this lower part side] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals, such as this, according to the invention concerning Claim 1 and Claim 3, and parallel arrangement was carried out in parallel, A film holding means is constituted from two or more jig groups which provide a predetermined interval in each guide rail, and it is equipped, and it runs each guide rail top, and grasp the transverse direction both ends of the above-mentioned thermoplastic resin film, The thermoplastic resin film by which horizontal uniaxial stretching was carried out to this film holding means is supplied, The interval of the tip side comrade between each jig makes the transverse direction both ends of the above-mentioned thermoplastic resin film grasp one by one in the curved-guides part of the guide rail which spreads from the end face side comrade's interval, and. According to the invention which slacks the above-mentioned thermoplastic resin film in the inside of the straight-line proposal of the guide rail where the interval of the tip side comrade between each jig is shortened at that end face side comrade's interval, carries out heat contraction of the longitudinal sizes of the above-mentioned thermoplastic resin film in this state where it slackened, and relates to Claim 2 and Claim 3. The first guide rail of endless form that comprises two curved-guides parts which connect the end comrade inside [which was extended to the abbreviated horizontal direction and equipped that way with the linear shape pars convoluta lobuli corticalis renis / which were provided in this lower part side] an upper part straight-line proposal, a bottom straight-line proposal, and straight-line proposals, such as this, The second guide rail of endless form in which has symmetrical shape to this first guide rail, and parallel arrangement of the interval between each inside of an upper part straight-line proposal was carried out so that the downstream might spread from the upstream bordering on the above-mentioned pars convoluta lobuli corticalis renis, A film holding means is constituted from two or more jig groups which provide a predetermined interval in each guide rail, and it is equipped, and it runs each guide rail top, and grasp the transverse direction both ends of the above-mentioned thermoplastic resin film, Supply a thermoplastic resin film to this film holding means, and the interval of the tip side comrade between each jig makes the transverse direction both ends of the above-mentioned thermoplastic resin film grasp one by one in the curved-guides part of the guide rail which spreads from that end face side comrade's interval, and. The above-mentioned thermoplastic resin film is slacked in the inside of the straight-line proposal of the guide rail where the interval of the tip side comrade between each jig is shortened at that end face side comrade's interval, and heat contraction of the longitudinal sizes of a thermoplastic resin film is carried out in this state, and stretching treatment is carried out to the transverse direction of

******.

[0040]As a result, since the stress (stress which it is going to reduce) of a direction vertical to the extension direction becomes small and optically uniaxial [of the called-for phase difference plate] increases, manufacture of a phase difference plate with a large angle of visibility is attained.

[0041]

[Example]Hereafter, working example of this invention is described in detail.

[0042][Working example 1] The tenter drawing machine was used and horizontal uniaxial stretching of 430 mm in width, 100 micrometers in thickness, and the glass transition point (Tg)190 ** polysulfone film was carried out on the conditions of the extension temperature of 190 **, the draw magnification of 1.5 times, the heat setting temperature of 170 **, and 30 sec of heat setting time.

[0043]Next, in the curved-guides part 13 of a guide rail, grasp the transverse direction both ends of the polysulfone film p in which horizontal uniaxial-stretching processing was carried out by the film holding means 10 shown in drawing 1 and drawing 5 one by one, and. After slacking the above-mentioned film p uniformly in the inside 11 of an upper part straight-line proposal, it heat-treated in the oven 4, heat contraction of the lengthwise direction of the polysulfone film p was carried out, and the phase difference plate was manufactured.

[0044]It was with h= 30 mm in height of the jig 2, and a turning radius [of the curved-guides part 13] of R= 200 mm conditions (13% of reduction percentage), and was for [cooking temperature / of 190 ** /, and cooking time] 4 minutes. What constitutes that principal part from the bottom clip 21 attached to the guide chain 20 with which a guide rail is equipped as each jig 2 is shown in drawing 6, and the upper part clip 22 removablely attached to this bottom clip 21 is applied.

[0045]And evaluation of the obtained phase difference plate (phase difference film) was performed about the homogeneity of a view angle characteristic, an R value, and an R value, and a gap of a drawing axis.

[0046]It centers upon the axis (inside of a film plane) which intersects perpendicularly with the drawing axis of a film, and a drawing axis as the above-mentioned view angle characteristic, The one where the value which hung 100 on the value which **(ed) the absolute value of the difference of the retardation values (590 nm) at the time of making it rotate 45 degrees and the retardation values at the time of 0 times by the retardation values (590 nm) at the time of 0 times is larger was made into the alternative characteristic. It can be said that the one where this value is smaller is excellent in a view angle characteristic.

[0047]Next, an R value is a phase difference value when a measured wavelength and a phase difference value are equal.

[0048]Dispersion in the retardation values of a film transverse direction made working width a less than **5-nm portion, and this rate of working width estimated the homogeneity of the R value.

[0049]It is asking for the rate of working width of the R value by the following calculations.

[0050]Rate of working width =(width after working width/extension) x100 (%) of an R value When the gap of an optical principal axis and a drawing axis, the cross direction, i.e., the transverse direction, of a film, was measured using the polarization microscope about the gap of

the drawing axis in a film end and the imperfect alignment exceeded 1 time, it presupposed that it is poor, and the one where poor width is larger was made into the central value by right and left.

[0051]It is asking for the end shaft gap defective fraction by the following calculations.

[0052]End shaft gap defective fraction =(width after poor width / extension) x100 (%)

And as for 13.2 and an R value, 70% and the end shaft gap defective fraction of 596.5 nm and the rate of working width of the R value were [view angle characteristic] 1.2% as a result of evaluation.

[0053][Working example 2] The tenter drawing machine was used and horizontal uniaxial stretching of 430 mm in width, 100 micrometers in thickness, and the glass transition point (Tg)190 ** polysulfone film was carried out on the conditions of the extension temperature of 190 **, the draw magnification of 1.5 times, the heat setting temperature of 170 **, and 30 sec of heat setting time.

[0054]Next, heat contraction of the above-mentioned PORUSARU phone film p was carried out using the thing of the same structure as the film holding means applied in working example 1, and the phase difference plate was manufactured. It was with h= 30 mm in height of the jig 2, and a turning radius [of the curved-guides part 13] of R= 150 mm conditions (16.6% of reduction percentage), and was for [cooking temperature / of 190 ** /, and cooking time] 4 minutes.

[0055]And when the homogeneity of the view angle characteristic, an R value, and an R value and a gap of a drawing axis were evaluated about the phase difference plate (phase difference film) obtained like working example 1, as for 12.3 and an R value, 64% and the end shaft gap defective fraction of 625.2 nm and the rate of working width of the R value were [view angle characteristic] 1.2%.

[0056][Comparative example 1] The tenter drawing machine was used and horizontal uniaxial stretching of 430 mm in width, 100 micrometers in thickness, and the glass transition point (Tg)190 ** polysulfone film was carried out on the conditions of the extension temperature of 190 **, the draw magnification of 1.5 times, the heat setting temperature of 170 **, and 30 sec of heat setting time.

[0057]Then, when the same evaluation as working example 1 was performed without performing heat contraction processing, 62% and the end shaft gap defective fraction of 577.3 nm and the rate of working width of an R value are 33%, and the view angle characteristic was inferior to working example in 30.3 and an R value.

[0058][Comparative example 2] The vertical uniaxial-stretching machine was used and vertical uniaxial stretching of 600 mm in width, 100 micrometers in thickness, and the glass transition point (Tg)190 ** polysulfone film was carried out by one 1.5 times the draw magnification [the extension temperature of 200 **, and] of this. The distance between extensions at that time (refer to the thick line part of drawing 10) was 800 mm, and the rate of the neck in (width x100% before width/extension) contracted by extension) was 17.2%.

[0059]When the evaluation same about the obtained phase difference plate as working example 1 was performed, 60% and the end shaft gap defective fraction of 646.7 nm and the rate of working width of an R value are 30%, and the view angle characteristic was inferior to working example in 13.1 and an R value.

[0060][Working example 3] 430 mm in width, 100 micrometers in thickness, and the transverse

direction both ends of a glass transition point (Tg)190 ** polysulfone film, In the curved-guides part 13 of that guide rail, it grasped one by one by the film holding means 10 shown in drawing 1 and drawing 4, and stretching treatment was carried out to that transverse direction, slacking the above-mentioned film uniformly in the inside 11 of an upper part straight-line proposal, and carrying out heat contraction of the lengthwise direction of a film in this state.

[0061]It was h= 30 mm in height of the jig 2, and R= 200 mm (13% of reduction percentage) in turning radius of the curved-guides part 13, and they were the conditions of the extension temperature of 190 **, the draw magnification of 1.5 times, the heat setting temperature of 170 **, and 30 sec of heat setting time.

[0062]And when the view angle characteristic, the R value, and the gap of a drawing axis were evaluated about the obtained phase difference plate (phase difference film), as for 13.8 and an R value, 602.5 nm and the end shaft gap defective fraction of the view angle characteristic were 1.2%.

[0063][Working example 4] 430 mm in width, 100 micrometers in thickness, and the transverse direction both ends of a glass transition point (Tg)190 ** polysulfone film, In the curved-guides part 13 of that guide rail, it grasped one by one by the film holding means 10 shown in drawing 1 and drawing 4, and stretching treatment was carried out to that transverse direction, slacking the above-mentioned film uniformly in the inside 11 of an upper part straight-line proposal, and carrying out heat contraction of the lengthwise direction of a film in this state.

[0064]It was h= 30 mm in height of the jig 2, and R= 150 mm (16.6% of reduction percentage) in turning radius of the curved-guides part 13, and they were the conditions of the extension temperature of 190 **, the draw magnification of 1.6 times, the heat setting temperature of 170 **, and 30 sec of heat setting time.

[0065]And when the view angle characteristic, the R value, and the gap of a drawing axis were evaluated about the obtained phase difference plate (phase difference film), as for 13.1 and an R value, 621.2 nm and the end shaft gap defective fraction of the view angle characteristic were 1.3%.

[0066][Comparative example 3] The tenter drawing machine was used and horizontal uniaxial stretching of 430 mm (distance between initial tenter clips of 400 mm) in width, 100 micrometers in thickness, and the glass transition point (Tg)190 ** polysulfone film was carried out on with the extension temperature of 195 **, the draw magnification of 1.35 times, and a heat setting temperature of 170 ** conditions.

[0067]And when the same evaluation as working example 3 was performed, 413 nm and an end shaft gap defective fraction are 31%, and the view angle characteristic was inferior to each working example in 31.6 and an R value.

[0068]

[Effect of the Invention]According to the invention concerning Claims 1-3, optically uniaxial [of the phase difference plate which the stress (stress which it is going to reduce) of the direction vertical to the extension direction became small, and was called for] increases, and the unevenness of the phase difference value also decreases.

[0069]Therefore, over the almost all region of a film, it is uniform and has the effect that the phase difference plate which has the outstanding phase contrast compensating performance and

a view angle characteristic can be manufactured easily.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The explanatory view showing the process of the manufacturing method concerning Claims 1-2.

[Drawing 2]The partial expansion explanatory view of drawing 1.

[Drawing 3]The explanatory view explaining the reduction percentage of the thermoplastic resin film concerning Claims 1-2.

[Drawing 4]The part plan of the film holding means concerning Claim 2.

[Drawing 5]The part plan of the film holding means concerning Claim 1.

[Drawing 6]The composition outline sectional view of the jig concerning Claim 3.

[Drawing 7]The perspective view of an uniaxial stretched film.

[Drawing 8]Graph charts showing the viewing angle theta and a relation with $R_{xz}(theta)/R_{xz}$ (0) in xz side.

[Drawing 9]Graph charts showing the viewing angle phi and a relation with $R_{yz}(phi)/R_{yz}$ (0) in yz side.

[Drawing 10]The explanatory view showing the vertical uniaxial-stretching method concerning the comparative example 2.

[Description of Notations]

p Film

1 Guide rail

2 Jig

3 Carrying roll

4 Oven

10 Film holding means

11 The inside of an upper part straight-line proposal

12 The inside of a bottom straight-line proposal

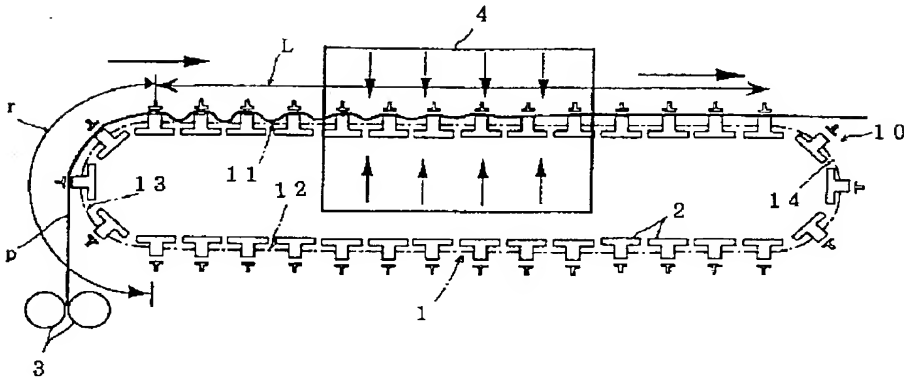
13 Curved-guides part

14 Curved-guides part

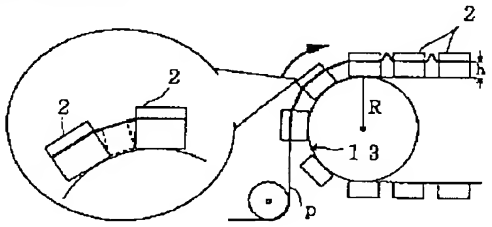
DRAWINGS

[Drawing 1]

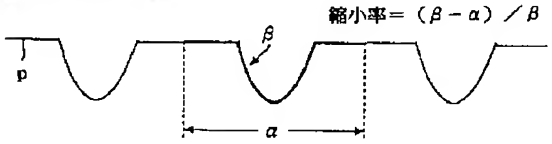
P	：フィルム	10	：フィルム把持手段
1	：ガイドレール	11	：上側直線案内部
2	：治具	12	：下側直線案内部
3	：搬送ロール	13	：曲線案内部
4	：オーブン	14	：曲線案内部



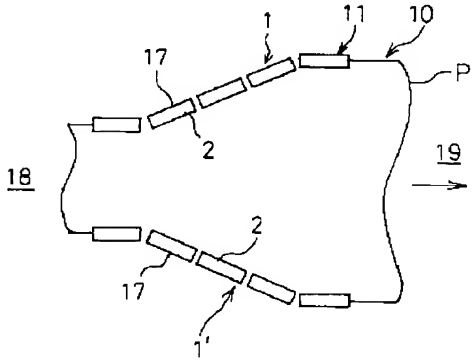
[Drawing 2]



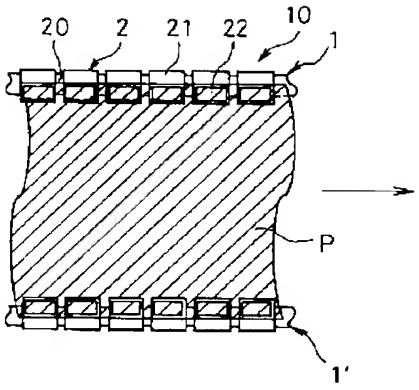
[Drawing 3]



[Drawing 4]



[Drawing 5]



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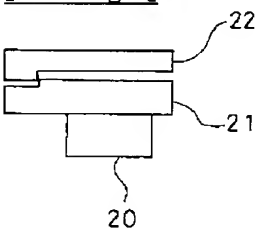
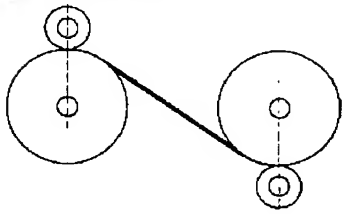
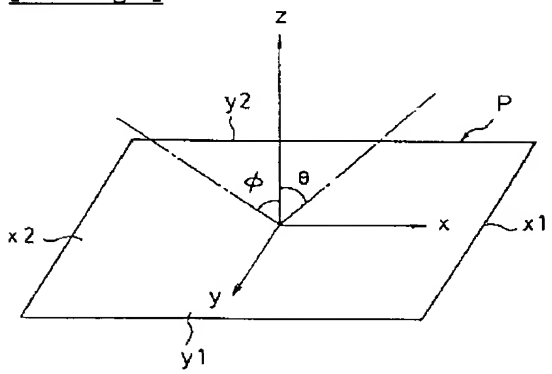


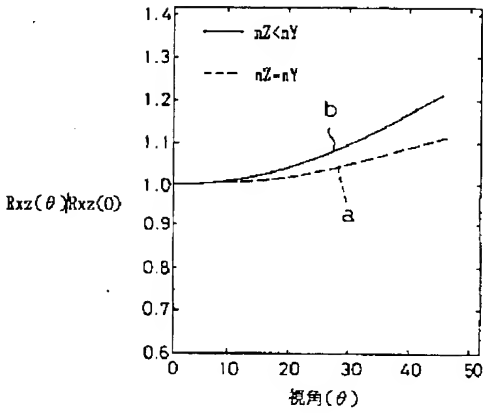
[Drawing 10]



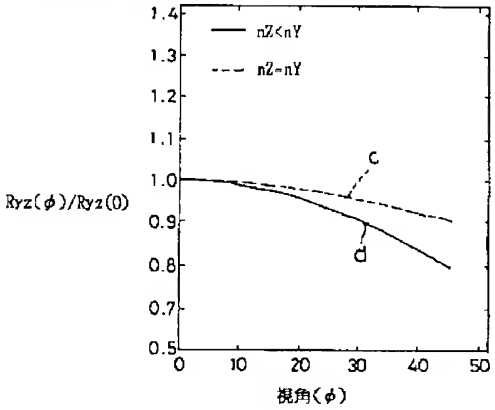
[Drawing 7]



[Drawing 8]


nZ<nY
nZ=nY
b
a
Rxz(θ)/Rxz(0)
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0
10
20
30
40
50
視角(θ)

[Drawing 9]


nZ<nY
nZ=nY
c
d
Ryz(φ)/Ryz(0)
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.5
0
10
20
30
40
50
視角(φ)

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Ｇ０２Ｆ	1/1335	５１０	7408－2K		

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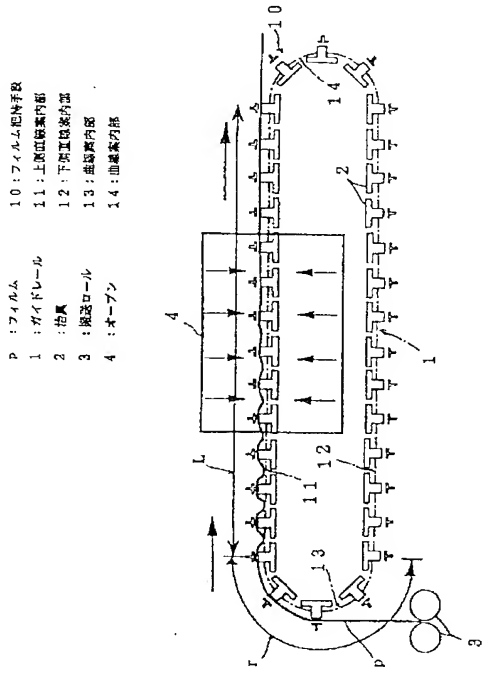
(54)【発明の名称】　位相差板の製造方法

(57)【要約】

【目的】　フィルムの略全域に亘り均一でかつ優れた位相差補償性能と視野角特性を有する位相差板を容易に製造できる方法を提供すること。

【構成】　上側直線案内部１１と下側直線案内部１２とこれ等直線案内部の端部同志を連結する２つの曲線案内部１３，１４から成り並列配置された一対の無端状ガイドレール１と、各ガイドレールに所定の間隔を設けて装着されかつ各ガイドレール上を走行すると共に熱可塑性樹脂フィルムｐの横方向両端部を把持する複数の治具２群とでフィルム把持手段１０を構成し、このフィルム把持手段に対して横一軸延伸された熱可塑性樹脂フィルムを供給し、ガイドレールの曲線案内部１３において上記フィルムの横方向両端部を順次把持させると共に、ガイドレールの上側直線案内部１１において上記フィルムを弛ませながらその縦方向を熱収縮させることを特徴する。



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【特許請求の範囲】

【請求項１】熱可塑性樹脂フィルムを横一軸延伸すると共にこの熱可塑性樹脂フィルムの縦方向を熱収縮させて位相差板を製造する方法において、

略水平方向に伸びる上側直線案内部とこの下方側に設けられた下側直線案内部とこれ等直線案内部の端部同志を連結する２つの曲線案内部から成り平行に並列配置された一対の無端状ガイドレールと、各ガイドレールに所定の間隔を設けて装着されかつ各ガイドレール上を走行すると共に上記熱可塑性樹脂フィルムの横方向両端部を把持する複数の治具群とでフィルム把持手段を構成し、

このフィルム把持手段に対して横一軸延伸された熱可塑性樹脂フィルムを供給し、各治具間の先端側同志の間隔がその基端側同志の間隔より広がるガイドレールの曲線案内部において上記熱可塑性樹脂フィルムの横方向両端部を順次把持させると共に、各治具間の先端側同志の間隔がその基端側同志の間隔に縮まるガイドレールの直線案内部において上記熱可塑性樹脂フィルムを弛ませ、かつ、この弛んだ状態で上記熱可塑性樹脂フィルムを熱収縮させることを特徴とする位相差板の製造方法。

【請求項２】熱可塑性樹脂フィルムを横一軸延伸すると共にこの熱可塑性樹脂フィルムの縦方向を熱収縮させて位相差板を製造する方法において、

略水平方向に伸びその途上に直線状の曲部を備えた上側直線案内部とこの下方側に設けられた下側直線案内部とこれ等直線案内部の端部同志を連結する２つの曲線案内部から成る無端状第一ガイドレールと、この第一ガイドレールに対して対称な形状を有し各上側直線案内部間の間隔が上記曲部を境にして上流側より下流側が広がるように並列配置された無端状第二ガイドレールと、各ガイドレールに所定の間隔を設けて装着されかつ各ガイドレール上を走行すると共に上記熱可塑性樹脂フィルムの横方向両端部を把持する複数の治具群とでフィルム把持手段を構成し、

このフィルム把持手段に対して熱可塑性樹脂フィルムを供給し、各治具間の先端側同志の間隔がその基端側同志の間隔より広がるガイドレールの曲線案内部において上記熱可塑性樹脂フィルムの横方向両端部を順次把持させると共に、各治具間の先端側同志の間隔がその基端側同志の間隔に縮まるガイドレールの直線案内部において上記熱可塑性樹脂フィルムを弛ませ、かつ、この状態で熱可塑性樹脂フィルムの縦方向を熱収縮させながらその横方向へ延伸処理することを特徴とする位相差板の製造方法。

【請求項３】上記治具が、ガイドレールに装着されるガイドチェーンに取付けられた下側クリップと、この下側クリップに対して接離可能に取付けられた上側クリップとでその主要部を構成していることを特徴とする請求項１又は２記載の位相差板の製造方法。

【発明の詳細な説明】

2

【０００１】

【産業上の利用分野】本発明は、一軸延伸された熱可塑性樹脂フィルムにて構成され、例えば液晶表示板等に好適に用いられる位相差板に係り、特に、視野角特性に優れしかも位相差値のむらが少ない位相差板の製造方法に関するものである。

【０００２】

【従来の技術】位相差板（フィルム）とは、延伸した高分子フィルムの複屈折性（延伸による分子配向により延伸方向とそれに直交する方向の屈折率が異なるために生ずる）を利用し、例えば液晶表示板の液晶で生じた位相差を解消させる（位相差補償という）もので、従来、この種の位相差板（フィルム）としてはセルロース系樹脂（特開昭６３－１６７３６３号公報参照）、塩化ビニル系樹脂（特公昭４５－３４４７７号公報、特開昭５６－１２５７０２号公報参照）、ポリカーボネート系樹脂（特公昭４１－１２１９０号公報、特開昭５６－１３０７０３号公報参照）、アクリロニトリル系樹脂（特開昭５６－１３０７０２号公報参照）、スチレン系樹脂（特開昭５６－１２５７０３号公報参照）、オレフィン系樹脂（特開昭６０－２４５０２号公報参照）等のフィルムを一軸延伸処理して製造できることが知られており、また、一軸延伸方法としては、縦一軸延伸（特開平２－１９１９０４号公報参照）、横一軸延伸（特開平２－４２４０６号公報参照）等が提案されている。

【０００３】そして、位相差板（フィルム）の上記位相差補償性能はレターデーション値と呼ばれ、Δｎ×ｄで表される。ここで、Δｎは屈折率の異方性、ｄはフィルムの肉厚である。

【０００４】ところで、入射光とフィルム面に対する法線との為す角が増大すると、上記レターデーション値は変化し（延伸方向を軸に回転させた場合と延伸方向に垂直な軸で回転させた場合とで増減は異なる）液晶表示の着色が生じる。

【０００５】位相差板（フィルム）のような光学異方体は３次元方向の屈折率（ｎｘ，ｎｙ，ｎｚ）が一様でなく、屈折率楕円体で表現される。そして、各方向の屈折率の関係は、例えば、図７に示す一軸延伸フィルムｐにおいて、ｘを延伸軸、ｙをフィルム面内の延伸方向と直交する軸、ｚをフィルムの法線方向とすると、固有屈折率が正のフィルムではｎｘ＞ｎｙ≧ｎｚの関係があり、固有屈折率が負のフィルムではｎｘ＜ｎｙ≦ｎｚの関係がある。また完全一軸延伸フィルムではフィルム面内の延伸方向と直交する方向ｙの屈折率ｎｙとフィルムの法線方向ｚの屈折率ｎｚは等しく、ｎｙ＝ｎｚが成立する。

【０００６】以下、一例としてｘｚ面内でｚ軸からθ（視角）傾斜した方向からみた複屈折［$\Delta n_{xz}(\theta)$］、レターデーション値［$R_{xz}(\theta)$］はそれぞれ以下の式で表される（電子材料１９９１年２月号第

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４０頁参照）。

【０００７】

＊【数１】

$$\Delta n_{XZ}(\theta) = nx \cdot nz \cdot n / (nx^2 \sin^2\theta - nz^2 \sin^2\theta + n^2 \cdot nz^2)^{1/2} - ny \quad (1)$$

$$R_{XZ}(\theta) = \Delta n_{XZ}(\theta) \cdot d / (1 - \sin^2\theta / n^2)^{1/2} \quad (2)$$

但し、式中ｄはフィルムの厚さ、ｎは平均屈折率である。

【０００８】そして、上記（１）（２）式に基づいて計算した結果を図８に示す。

【０００９】図８のグラフ図において、横軸は視角θ、縦軸はｘｚ面内で視角θにおけるレターデーション値R_{xz}（θ）を視角０（法線方向ｚから見た場合）のレターデーション値R_{xz}（０）で割った値R_{xz}（θ）／R_{xz}（０）を示し、レターデーションＲの変化率は［１－R_{xz}（θ）／R_{xz}（０）］の絶対値で表される。また、図８中ａはｎｚ＝ｎｙの完全一軸延伸フィルムを示し、ｂはｎｚ＜ｎｙの完全一軸延伸フィルムを示している。

【００１０】ここで、視野角は、レターデーションＲの変化率、すなわち［１－R_{xz}（θ）／R_{xz}（０）］の絶対値が小さい程広いのである。そして、図８より完全一軸延伸（ｎｚ＝ｎｙ）の方がレターデーション値の変化が少なくかつ視野角が広くなり、他方、分子の配向に二軸性が存在すると（ｎｚ＜ｎｙ）上述のレターデーション値の変化は大きくかつ視野角が非常に狭くなることが確認できる。

【００１１】また、θの代わりに、ｙｚ面内でｚ軸から傾斜した視角φを用いた場合の計算結果を図９に示す。図９中ｃはｎｚ＝ｎｙの完全一軸延伸フィルムを示し、ｄはｎｚ＜ｎｙの完全一軸延伸フィルムを示している。

【００１２】そして、この結果からも分子の配向に二軸性があるとレターデーション値の変化率、すなわち［１－R_{yz}（φ）／R_{yz}（０）］の絶対値が大きく視野角が狭くなり、他方、分子の一軸配向性が高い程レターデーション値の変化率、すなわち［１－R_{yz}（φ）／R_{yz}（０）］の絶対値が小さくかつ視野角が広くなる。また、ｎｚ＝ｎｙの完全一軸延伸の場合が最も視野角が広くなることが分かる。

【００１３】従って、これ等図８及び図９の結果からいずれの方向から見る場合も分子の一軸配向性が高い程レターデーション値の変化率が小さくかつ視野角が広いことが分かる。

【００１４】ところで、分子配向の一軸性を高めるためには延伸方向と垂直な方向に発生する応力（縮小しようとする残留応力）をできるだけ小さくすることが必要である。言い換えると、延伸方向と垂直な方向に延伸で生じると考えられる縮小量だけ延伸方向と垂直な方向に縮小すれば良いのである。

【００１５】特開平２－１９１９０４号公報には、この縮小率［ネックイン率（延伸前後の延伸方向と直交する方向のフィルムの長さ変化率をいう）と以下称する。すなわちネックイン率＝（Ｂ－Ａ）／Ｂ×１００；ここでＡはアニール後の延伸方向と直交する方向の長さ、Ｂは延伸前のフィルムの延伸方向と直交する方向の長さである］を検討し、このネックイン率を（１－１／延伸倍率の平方根）×１００（％）～（１－１／延伸倍率の３乗根）×１００（％）にすることにより視野角特性に優れた位相差板（フィルム）が製造できることを開示している。そしてこの具体的な方法として、延伸ロール間距離をフィルム幅の５倍以上に設定し幅方向の自由な収縮を許しながら縦方向に延伸する方法（縦一軸自由幅延伸法）が開示されている。

【００１６】また、特開平３－２３４０５号公報には、パンタグラフ式同時二軸テンター延伸機を適用し、フィルムの幅方向両端部を部分的にテンタークリップで保持して縦方向及び幅方向の両方向を同時に延伸し、０～（１－１／延伸倍率の平方根）のネックイン率を有する位相差板を製造する方法が開示されている。

【００１７】

【発明が解決しようとする課題】しかし、特開平２－１９１９０４号公報に開示されている方法は上述したように延伸ロール間距離をフィルム幅の５倍以上に設定しているため、ロール間の全域に亘り延伸中の加熱温度を均一に制御することが困難な問題点があった。

【００１８】また、この方法では間隔を開けて配置された延伸ロール間においてフィルムの幅方向の自由な収縮を許しながらフィルム縦方向への延伸処理を施しているため、延伸ロール近傍部位におけるフィルムの幅方向の収縮量に較べて延伸ロール間中央部付近におけるフィルムの幅方向収縮量が大きくなり、この収縮率の差異に起因してフィルムの幅方向両端部における延伸軸（延伸主軸）の方向とフィルム中央部における延伸軸の方向とが一致しなくなる欠点があった。従って、延伸処理されたフィルムの幅方向両端部と中央部とでその位相差補償性能や視野角特性が相違するためフィルムの幅方向両端部を不良品として大量に廃棄しなければならず、歩留まりが悪いといった問題点があった。

【００１９】他方、特開平３－２３４０５号公報に開示されている方法においては、フィルムの幅方向両端部をテンタークリップにより部分的に保持して延伸処理を施

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しているため、上記テンタークリップにて保持されない部位においてネックインが発生し、製造された位相差板の位相差補償性能と視野角特性の均一性に問題があった。

【００２０】本発明はこのような問題点に着目してなされたもので、その課題とするところは、フィルムの略全域に亘り均一でかつ優れた位相差補償性能と視野角特性を有する位相差板を容易に製造できる方法を提供することにある。

【００２１】

【課題を解決するための手段】すなわち、請求項１に係る発明は、熱可塑性樹脂フィルムを横一軸延伸すると共にこの熱可塑性樹脂フィルムの縦方向を熱収縮させて位相差板を製造する方法を前提とし、略水平方向に伸びる上側直線案内部とこの下方側に設けられた下側直線案内部とこれ等直線案内部の端部同志を連結する２つの曲線案内部から成り平行に並列配置された一対の無端状ガイドレールと、各ガイドレールに所定の間隔を設けて装着されかつ各ガイドレール上を走行すると共に上記熱可塑性樹脂フィルムの横方向両端部を把持する複数の治具群とでフィルム把持手段を構成し、このフィルム把持手段に対して横一軸延伸された熱可塑性樹脂フィルムを供給し、各治具間の先端側同志の間隔がその基端側同志の間隔より広がるガイドレールの曲線案内部において上記熱可塑性樹脂フィルムの横方向両端部を順次把持させると共に、各治具間の先端側同志の間隔がその基端側同志の間隔に縮まるガイドレールの直線案内部において上記熱可塑性樹脂フィルムを弛ませ、かつ、この弛んだ状態で上記熱可塑性樹脂フィルムを熱収縮させることを特徴とし、他方、請求項２に係る発明は、熱可塑性樹脂フィルムを横一軸延伸すると共にこの熱可塑性樹脂フィルムの縦方向を熱収縮させて位相差板を製造する方法を前提とし、略水平方向に伸びその途上に直線状の曲部を備えた上側直線案内部とこの下方側に設けられた下側直線案内部とこれ等直線案内部の端部同志を連結する２つの曲線案内部から成る無端状第一ガイドレールと、この第一ガイドレールに対して対称な形状を有し各上側直線案内部間の間隔が上記曲部を境にして上流側より下流側が広がるように並列配置された無端状第二ガイドレールと、各ガイドレールに所定の間隔を設けて装着されかつ各ガイドレール上を走行すると共に上記熱可塑性樹脂フィルムの横方向両端部を把持する複数の治具群とでフィルム把持手段を構成し、このフィルム把持手段に対して熱可塑性樹脂フィルムを供給し、各治具間の先端側同志の間隔がその基端側同志の間隔より広がるガイドレールの曲線案内部において上記熱可塑性樹脂フィルムの横方向両端部を順次把持させると共に、各治具間の先端側同志の間隔がその基端側同志の間隔に縮まるガイドレールの直線案内部において上記熱可塑性樹脂フィルムを弛ませ、かつ、この状態で熱可塑性樹脂フィルムの縦方向を熱収縮させながらその横方向へ延伸処理することを特徴とするものである。

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【００２２】また、請求項３に係る発明は、請求項１又は２記載の位相差板の製造方法を前提とし、上記治具が、ガイドレールに装着されるガイドチェーンに取付けられた下側クリップと、この下側クリップに対して接離可能に取付けられた上側クリップとでその主要部を構成していることを特徴とするものである。

【００２３】このような技術的手段において視野角の広い位相差板を製造するには分子配向の一軸性を高める必要がある。そのためには、上述したように延伸方向に垂直な方向に発生する応力（縮小しようとする応力）をできるだけ小さくする必要がある。言い換えると延伸方向に垂直な方向に延伸で発生する応力に相当する縮小量だけ延伸時または延伸後に縮小してやればよい。

【００２４】そして、請求項１に係る発明においては横一軸延伸したフィルムを治具間で弛ませ、この弛んだ状態でフィルムの縦方向を熱収縮させて位相差板の一軸性を高めている。

【００２５】すなわち、図１に示すように水平方向に伸びる上側直線案内部１１とこの下方側に設けられた下側直線案内部１２とこれ等直線案内部１１、１２の端部同志を連結する２つの曲線案内部１３、１４から成り平行に並列配置された一対の無端状ガイドレール１（一方は図示せず）と、各ガイドレール１に所定の間隔を設けて装着されかつ各ガイドレール１上を走行すると共に熱可塑性フィルムｐの横方向両端部を把持する複数の治具２群とでフィルム把持手段１０を構成し、このフィルム把持手段１０に対し横一軸延伸された熱可塑性樹脂フィルムｐを搬送ロール３を介して供給し、図１～図２に示すように各治具２間の先端側同志の間隔がその基端側同志の間隔より広がるガイドレール１の曲線案内部１３において上記熱可塑性樹脂フィルムｐの横方向両端部を順次把持させると共に、各治具２間の先端側同志の間隔がその基端側同志の間隔に縮まるガイドレール１の上側直線案内部１１において上記熱可塑性樹脂フィルムｐを均一に弛ませた後、オーブン４にて加熱処理を施し熱可塑性樹脂フィルムｐの縦方向を熱収縮させて位相差板の一軸性を高めたものである。すなわち、請求項１に係る発明は、各治具２間の先端側同志の間隔が、曲線案内部１３の曲線走行時（区間ｒ）と直線案内部１１の直線走行時（区間Ｌ）とで異なることを利用したものである。

【００２６】尚、図１においては熱可塑性樹脂フィルムｐを下方側から供給しその曲線案内部１３において治具２により順次把持させた後、上側直線案内部１１において熱可塑性樹脂フィルムｐを弛ませながら熱収縮させているが、上記熱可塑性樹脂フィルムｐを上方側から供給しその曲線案内部１３において治具２により順次把持させた後、下側直線案内部１２において熱可塑性樹脂フィルムｐを弛ませながら熱収縮させる方式を採ってもよ

い。

【００２７】そして、縮小量は、図２に示すように治具２の高さｈと上記曲線案内部１３の回転半径Ｒにより自由に設定できる。この縮小率は、図３に示すように治具間で弛んだ状態における（β－α）／βで与えられる。但し、βはフィルムｐの弛み分の長さ、αは各治具間の間隔（すなわち各治具間の基端側同志の間隔）を示している。

【００２８】以下、表１において上記Ｒ、ｈと縮小率の関係を例示する。

【００２９】

【表１】

R ＼ h	２０ mm	３０ mm
１００ mm	１６．５ %	２２．８ %
１５０ mm	１１．７ %	１６．６ %
２００ mm	９．１ %	１３．０ %

尚、請求項１に係る発明においては予め横一軸延伸した熱可塑性樹脂フィルムを上記フィルム把持手段に供給して位相差板を製造しているが、請求項２に係る発明においては上記熱可塑性樹脂フィルムの横方向（すなわち幅方向）への延伸処理と縦方向への熱収縮処理を同時に行うことを特徴としている。

【００３０】すなわち、図４に示すように略水平方向へ伸びその途上に直線状の曲部１７をを備えた上側直線案内部１１とこの下方側に設けられた下側直線案内部（図示せず）とこれ等直線案内部の端部同志を連結する２つの曲線案内部（図示せず）から成る無端状第一ガイドレール１と、この第一ガイドレール１に対して対称な形状を有し各上側直線案内部間の間隔が上記曲部１７を境にして上流側１８より下流側１９が広がるように並列配置された無端状第二ガイドレール１’と、各ガイドレール１、１’に所定の間隔を設けて装着されかつ各ガイドレール１、１’上を走行すると共に熱可塑性樹脂フィルムｐの横方向両端部を把持する複数の治具２群とでフィルム把持手段を構成した点を除き請求項１に係る発明と略同一である。

【００３１】これ等請求項１～２に係る発明において上記ガイドレールに装着される治具としては、フィルムに破れや滑りが起こらないものであればいかなるものでも適用可能である。一例として、テンタークリップやピン、針等が挙げられる。

【００３２】そして、上述した特開平２－１９１９０４号公報における自由延伸の問題点であるネックインの不良部（軸ずれ）は、延伸直交方向に拘束されていないため延伸軸（位相差板の光学主軸）が中央と両端部で大きくずれて発生していた。

【００３３】これに対し、請求項１～３に係る発明においてはフィルムの弛みにより生じた波形形状がフィルムの延伸直交方向に対し拘束力として作用しフィルムの縦方向の均等な収縮を可能にするため、上記特開平２－１９１９０４号公報に開示された製造方法の弊害を解消する。

【００３４】また、実際の設備としては、横一軸延伸機においてフィルムの横方向両端部を把持する治具の駆動を上述したような構造に改造した装置が適用でき、特開平２－１９１９０４号公報に開示された製造方法との比較においては延伸時の延伸温度の制御が容易であり、また、特開平３－２３４０５号公報に開示された製造方法との比較においては安価で簡単な装置の適用が可能である。

【００３５】請求項１～３に係る発明における横一軸延伸とはテンター延伸機による横一軸延伸であり、その延伸温度、延伸倍率、延伸速度、ヒートセット（延伸後の熱処理）温度、ヒートセット時間等の諸条件は所望の位相差値になるよう適宜設定されるものである。

【００３６】また、これ等発明における熱処理は、熱可塑性樹脂フィルムの横方向両端部をガイドレールの曲線案内部で把持する工程と、ガイドレールの直線案内部において上記フィルムを熱収縮工程から成り、加熱温度、加熱速度、延伸方向と直交する方向の縮小量等の諸条件は所望の位相差値になるよう適宜設定されるものである。

【００３７】次に、この技術的手段において適用される熱可塑性樹脂フィルムとしては、例えば、セルロース系樹脂、塩化ビニル系樹脂、ポリカーボネート系樹脂、アクリロニトリル系樹脂、オレフィン系樹脂、ポリスチレン系樹脂、ポリメタクリル酸メチル系樹脂、ポリサルフォン系樹脂、ポリアリレート系樹脂、ポリエーテルサルフォン系樹脂等のフィルムが挙げられる。

【００３８】また、これらフィルムの製造方法としては、溶剤キャスト法、カレンダー法又は押出し法のいずれによって製造してもよい。

【００３９】

【作用】請求項１及び請求項３に係る発明によれば、略水平方向に伸びる上側直線案内部とこの下方側に設けられた下側直線案内部とこれ等直線案内部の端部同志を連結する２つの曲線案内部から成り平行に並列配置された一対の無端状ガイドレールと、各ガイドレールに所定の間隔を設けて装着されかつ各ガイドレール上を走行すると共に上記熱可塑性樹脂フィルムの横方向両端部を把持する複数の治具群とでフィルム把持手段を構成し、このフィルム把持手段に対して横一軸延伸された熱可塑性樹脂フィルムを供給し、各治具間の先端側同志の間隔がその基端側同志の間隔より広がるガイドレールの曲線案内

部において上記熱可塑性樹脂フィルムの横方向両端部を順次把持させると共に、各治具間の先端側同志の間隔がその基端側同志の間隔に縮まるガイドレールの直線案内部において上記熱可塑性樹脂フィルムを弛ませ、かつ、この弛んだ状態で上記熱可塑性樹脂フィルムの縦方向寸法を熱収縮させており、また、請求項２及び請求項３に係る発明によれば、略水平方向に伸びその途上に直線状の曲部を備えた上側直線案内部とこの下方側に設けられた下側直線案内部とこれ等直線案内部の端部同志を連結する２つの曲線案内部から成る無端状第一ガイドレールと、この第一ガイドレールに対して対称な形状を有し各上側直線案内部間の間隔が上記曲部を境にして上流側より下流側が広がるように並列配置された無端状第二ガイドレールと、各ガイドレールに所定の間隔を設けて装着されかつ各ガイドレール上を走行すると共に上記熱可塑性樹脂フィルムの横方向両端部を把持する複数の治具群とでフィルム把持手段を構成し、このフィルム把持手段に対して熱可塑性樹脂フィルムを供給し、各治具間の先端側同志の間隔がその基端側同志の間隔より広がるガイドレールの曲線案内部において上記熱可塑性樹脂フィルムの横方向両端部を順次把持させると共に、各治具間の先端側同志の間隔がその基端側同志の間隔に縮まるガイドレールの直線案内部において上記熱可塑性樹脂フィルムを弛ませ、かつ、この状態で熱可塑性樹脂フィルムの縦方向寸法を熱収縮させながらその横方向へ延伸処理している。

【００４０】この結果、延伸方向と垂直な方向の応力（縮小しようとする応力）が小さくなり、求められた位相差板の一軸性が高まるため視野角の広い位相差板の製造が可能となる。

【００４１】

【実施例】以下、本発明の実施例について詳細に説明する。

【００４２】［実施例１］幅４３０ｍｍ、厚さ１００μｍ、ガラス転移点（Ｔｇ）１９０℃のポリサルフォンフィルムをテンター延伸機を使用し、延伸温度１９０℃、延伸倍率１．５倍、ヒートセット温度１７０℃、ヒートセット時間３０sec の条件で横一軸延伸した。

【００４３】次に、図１及び図５に示したフィルム把持手段１０により横一軸延伸処理されたポリサルフォンフィルムｐの横方向両端部をガイドレールの曲線案内部１３において順次把持すると共に、上側直線案内部１１において上記フィルムｐを均一に弛ませた後、オーブン４にて加熱処理を施しポリサルフォンフィルムｐの縦方向を熱収縮させて位相差板を製造した。

【００４４】尚、治具２の高さｈ＝３０ｍｍ、曲線案内部１３の回転半径Ｒ＝２００ｍｍの条件（縮小率１３％）で、かつ、加熱温度１９０℃、加熱時間４分間であった。また、各治具２は、図６に示すようにガイドレールに装着されるガイドチェーン２０に取付けられた下側

クリップ２１と、この下側クリップ２１に対して接離可能に取付けられた上側クリップ２２とでその主要部を構成するものが適用されている。

【００４５】そして、得られた位相差板（位相差フィルム）の評価は、視野角特性、Ｒ値、Ｒ値の均一性、及び、延伸軸のずれについて行なった。

【００４６】上記視野角特性としては、フィルムの延伸軸及び延伸軸と直交する軸（フィルム面内）を軸とし、４５度回転させたときのレターデーション値（５９０ｎｍ）と０度のときのレターデーション値の差の絶対値を、０度のときのレターデーション値（５９０ｎｍ）で除した値に１００を掛けた値の大きい方を代用特性とした。尚、この値が小さい方が視野角特性が優れているといえる。

【００４７】次に、Ｒ値は、測定波長と位相差値が等しいときの位相差値である。

【００４８】Ｒ値の均一性については、フィルム横方向のレターデーション値のばらつきが±５ｎｍ以内の部分を有効幅とし、この有効幅率で評価した。

【００４９】尚、Ｒ値の有効幅率は以下の計算により求めている。

【００５０】Ｒ値の有効幅率＝（有効幅／延伸後の幅）×１００（％）

また、フィルム端部における延伸軸のずれについては偏光顕微鏡を用い、光学主軸と延伸軸（フィルムの幅方向すなわち横方向）のずれを測定し、軸ずれが１度を越えると不良とし、左右で不良幅の大きい方を代表値とした。

【００５１】尚、端部軸ずれ不良率は以下の計算により求めている。

【００５２】端部軸ずれ不良率＝（不良幅／延伸後の幅）×１００（％）

そして、評価の結果、視野角特性は１３．２、Ｒ値は５９６．５ｎｍ、Ｒ値の有効幅率は７０％、及び、端部軸ずれ不良率は１．２％であった。

【００５３】［実施例２］幅４３０ｍｍ、厚さ１００μｍ、ガラス転移点（Ｔｇ）１９０℃のポリサルフォンフィルムをテンター延伸機を使用し、延伸温度１９０℃、延伸倍率１．５倍、ヒートセット温度１７０℃、ヒートセット時間３０sec の条件で横一軸延伸した。

【００５４】次に、実施例１において適用したフィルム把持手段と同一構造のものを用い上記ポルサルフォンフィルムｐを熱収縮させて位相差板を製造した。尚、治具２の高さｈ＝３０ｍｍ、曲線案内部１３の回転半径Ｒ＝１５０ｍｍの条件（縮小率１６．６％）で、かつ、加熱温度１９０℃、加熱時間４分間であった。

【００５５】そして、実施例１と同様に得られた位相差板（位相差フィルム）についてその視野角特性、Ｒ値、Ｒ値の均一性、及び、延伸軸のずれを評価したところ、視野角特性は１２．３、Ｒ値は６２５．２ｎｍ、Ｒ値の

有効幅率は６４％、及び、端部軸ずれ不良率は１．２％であった。

【００５６】［比較例１］幅４３０ｍｍ、厚さ１００μｍ、ガラス転移点（Ｔｇ）１９０℃のポリサルフォンフィルムをテンター延伸機を使用し、延伸温度１９０℃、延伸倍率１．５倍、ヒートセット温度１７０℃、ヒートセット時間３０sec の条件で横一軸延伸した。

【００５７】この後、熱収縮処理を行わずに実施例１と同様の評価を行ったところ、視野角特性は３０．３、Ｒ値は５７７．３ｎｍ、Ｒ値の有効幅率は６２％、及び、端部軸ずれ不良率は３３％であり、実施例より劣っていた。

【００５８】［比較例２］幅６００ｍｍ、厚さ１００μｍ、ガラス転移点（Ｔｇ）１９０℃のポリサルフォンフィルムを縦一軸延伸機を使用し、延伸温度２００℃、延伸倍率１．５倍で縦一軸延伸した。そのときの延伸間距離（図１０の太線部参照）は８００ｍｍであり、ネックイン率（延伸により収縮した幅／延伸前の幅×１００％）は１７．２％であった。

【００５９】得られた位相差板について実施例１と同様の評価を行ったところ、視野角特性は１３．１、Ｒ値は６４６．７ｎｍ、Ｒ値の有効幅率は６０％、及び、端部軸ずれ不良率は３０％であり、実施例より劣っていた。

【００６０】［実施例３］幅４３０ｍｍ、厚さ１００μｍ、ガラス転移点（Ｔｇ）１９０℃のポリサルフォンフィルムの横方向両端部を、図１及び図４に示したフィルム把持手段１０によりそのガイドレールの曲線案内部１３において順次把持すると共に、上側直線案内部１１において上記フィルムを均一に弛ませ、かつ、この状態でフィルムの縦方向を熱収縮させながらその横方向へ延伸処理した。

【００６１】尚、治具２の高さｈ＝３０ｍｍ、及び、曲線案内部１３の回転半径Ｒ＝２００ｍｍ（縮小率１３％）であり、また、延伸温度１９０℃、延伸倍率１．５倍、ヒートセット温度１７０℃、ヒートセット時間３０sec の条件であった。

【００６２】そして、得られた位相差板（位相差フィルム）についてその視野角特性、Ｒ値、及び、延伸軸のずれを評価したところ、視野角特性は１３．８、Ｒ値は６０２．５ｎｍ、及び、端部軸ずれ不良率は１．２％であった。

【００６３】［実施例４］幅４３０ｍｍ、厚さ１００μｍ、ガラス転移点（Ｔｇ）１９０℃のポリサルフォンフィルムの横方向両端部を、図１及び図４に示したフィルム把持手段１０によりそのガイドレールの曲線案内部１３において順次把持すると共に、上側直線案内部１１において上記フィルムを均一に弛ませ、かつ、この状態でフィルムの縦方向を熱収縮させながらその横方向へ延伸処理した。

【００６４】尚、治具２の高さｈ＝３０ｍｍ、及び、曲線案内部１３の回転半径Ｒ＝１５０ｍｍ（縮小率１６．６％）であり、また、延伸温度１９０℃、延伸倍率１．６倍、ヒートセット温度１７０℃、ヒートセット時間３０sec の条件であった。

【００６５】そして、得られた位相差板（位相差フィルム）についてその視野角特性、Ｒ値、及び、延伸軸のずれを評価したところ、視野角特性は１３．１、Ｒ値は６２１．２ｎｍ、及び、端部軸ずれ不良率は１．３％であった。

【００６６】［比較例３］幅４３０ｍｍ（初期テンタークリップ間距離４００ｍｍ）、厚さ１００μｍ、ガラス転移点（Ｔｇ）１９０℃のポリサルフォンフィルムをテンター延伸機を使用し、延伸温度１９５℃、延伸倍率１．３５倍、ヒートセット温度１７０℃の条件で横一軸延伸した。

【００６７】そして、実施例３と同様の評価を行ったところ、視野角特性は３１．６、Ｒ値は４１３ｎｍ、及び、端部軸ずれ不良率は３１％であり、各実施例より劣っていた。

【００６８】

【発明の効果】請求項１～３に係る発明によれば、延伸方向と垂直な方向の応力（縮小しようとする応力）が小さくなり求められた位相差板の一軸性が高まると共にその位相差値のむらも少なくなる。

【００６９】従って、フィルムの略全域にわたって均一でかつ優れた位相差補償性能と視野角特性を有する位相差板を容易に製造できる効果を有している。

【図面の簡単な説明】

【図１】請求項１～２に係る製造方法の工程を示す説明図。

【図２】図１の一部拡大説明図。

【図３】請求項１～２に係る熱可塑性樹脂フィルムの縮小率を説明する説明図。

【図４】請求項２に係るフィルム把持手段の部分平面図。

【図５】請求項１に係るフィルム把持手段の部分平面図。

【図６】請求項３に係る治具の構成概略断面図。

【図７】一軸延伸フィルムの斜視図。

【図８】ｘｚ面内で視角θとR_{xz}（θ）／R_{xz}（０）との関係を示すグラフ図。

【図９】ｙｚ面内で視角φとR_{yz}（φ）／R_{yz}（０）との関係を示すグラフ図。

【図１０】比較例２に係る縦一軸延伸法を示す説明図。

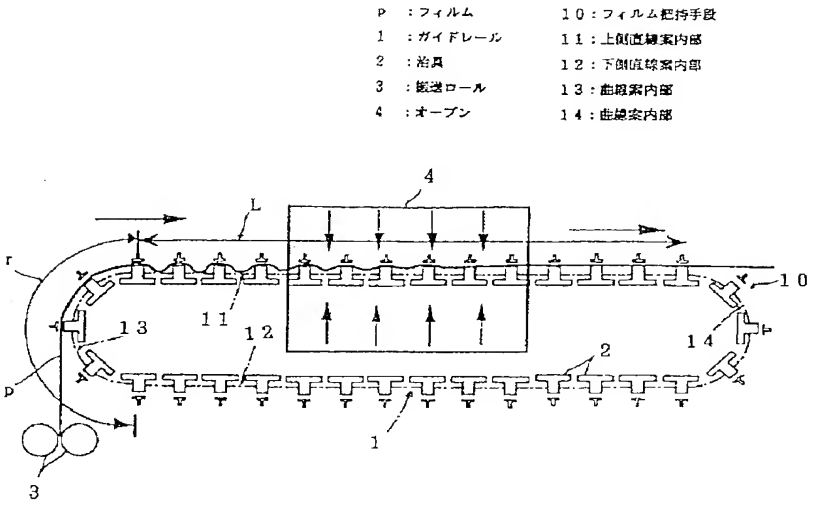
【符号の説明】

ｐ　フィルム
１　ガイドレール
２　治具
３　搬送ロール
４　オーブン

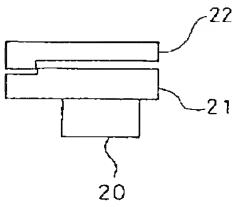
13　　14

１０　フィルム把持手段
１１　上側直線案内部
１２　下側直線案内部
＊１３　曲線案内部
１４　曲線案内部
＊

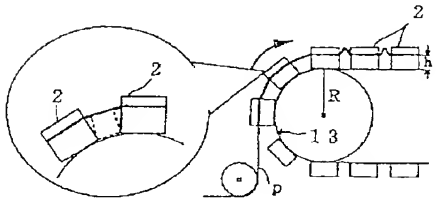
【図１】



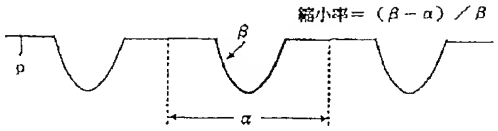
【図６】



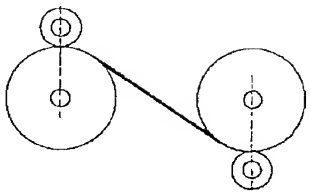
【図２】



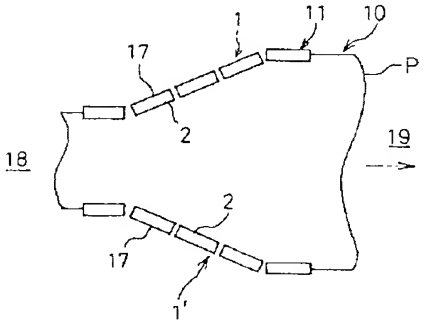
【図３】



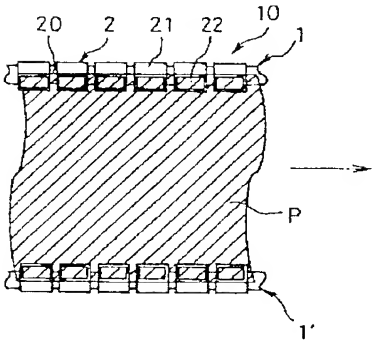
【図１０】



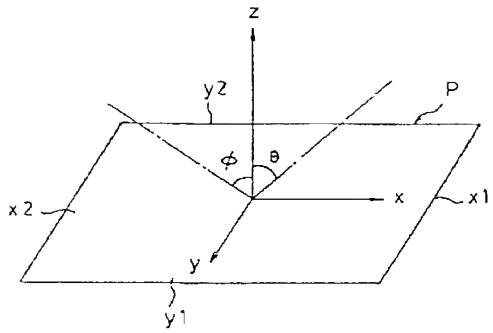
【図４】



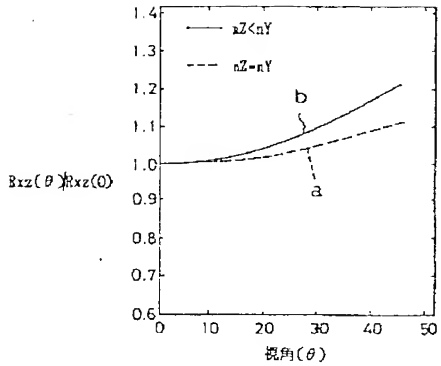
【図５】



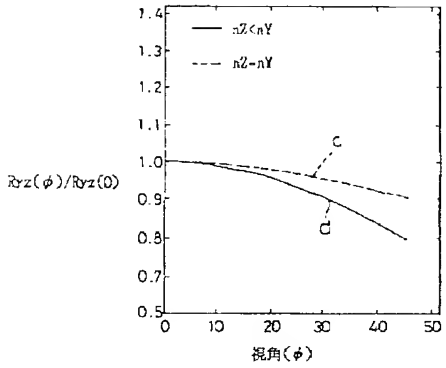
【図７】


z
y2
P
φ
θ
x
x2
x1
y
y1

【図８】


nZ<nY
nZ=nY
b
a
Rxz(θ)/Rxz(0)
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0
10
20
30
40
50
視角(θ)

【図９】


nZ<nY
nZ=nY
c
d
Ryz(φ)/Ryz(0)
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.5
0
10
20
30
40
50
視角(φ)